4.1 BIOLOGICAL RESOURCES

4.1.1 Environmental Setting

This section discusses the marine communities in the vicinity of Agua Hedionda entrance channel and the potential impacts of the jetty restoration project on these communities. The shallow subtidal region both upcoast and downcoast of the entrance jetties contains a number of rocky reefs supporting a variety of communities including beds of surfgrass (*Phyllospadix torreyi*). In deeper waters, just upcoast of the jetty entrance, is a region of hard substrate that supports a *Macrocystis pyrifera* kelp community. The Lagoon habitat, where ocean water circulation is maintained by the jetty structures, supports a large eelgrass (*Zostera marina*), population that in turn supports a rich and diverse fish community. The rock riprap of the jetty itself supports an abundant intertidal mussel community.

The project area for this study is defined as the area encompassing Agua Hedionda Lagoon and the nearshore zone extending approximately 2,000 feet upcoast and downcoast of the Lagoon entrance. The area of interest extends from the intertidal (mean high water (MHW)) down to a depth of 50 feet (Figure 4.1-1).

The three marine plant communities in the vicinity of Agua Hedionda Lagoon inlet jetties are regarded as the most important marine communities in southern California. The kelp beds serve as important habitat for hundreds of species of fishes, invertebrates, and algae (Foster & Schiel 1985). Many of the fish and invertebrate species found in the kelp beds form the basis of the commercial fisheries in the region. The kelp canopy is also harvested directly for the production of alginates. The eelgrass beds of the shallow Lagoon habitats, like the offshore kelp beds, are important habitat for both adult and juvenile fishes, which include important commercial and sport fishes such as the California halibut and white seabass. The surfgrass beds of the intertidal and shallow subtidal of the outer coast are important nursery habitat for California spiny lobster.

The annual landings for all commercially important species at Oceanside Harbor averaged $180,000 during the period from 1981 to 1998. The most important species was the spiny lobster, which comprised 68 percent of the total value of landings. The other top five species were spot prawns, rock crabs, sheephead, and halibut. Sport fishing and diving are other economically important activities in the region that utilize these coastal resources (SANDAG 2000).

INSERT FIGURE 4.1-1

McGowan (1971) and Briggs (1974) describe two zoogeographic provinces in California marine waters: the Oregonian Province from Point Conception north to either Cape Flattery, Washington or the Alaska-British Columbia border; and the San Diego Province from Point Conception south to Magdalena Bay, Baja, California. The project area falls within the San Diego province or Southern California Bight that is characterized by the warm-temperate water regime south of Point Conception. Point Conception forms the major oceanographic and biogeographic boundary in the state, but many dominant species in southern California extend beyond this boundary into central and northern California. For example, the giant kelp, (*Macrocystis pyrifera)*, which forms the extensive kelp bed canopies in southern California, extends into the Monterey Bay area. The distributions of species within the Southern California Bight are related to the complex hydrography and geology of the region.

The coastline in the vicinity of the Agua Hedionda Lagoon entrance consists of a sandy/cobble beach backed by bluffs rising to 42 feet to 85 feet, except between the Lagoon inlet and the cooling water discharge channel for the Encina Generating Station. The coastal bluffs are remnant marine terraces that have been eroded by coastal wave action. The nearshore ocean floor consists of a sandy bottom with numerous low-lying rock outcrops. These rock outcrops have a mean relief of approximately 2 feet, but a few of the reefs have relief between 4 and 6 feet. The ocean floor slopes fairly uniformly to a depth of 600 feet approximately 1.5 miles offshore. This region of the shelf is cut with numerous submarine canyons, including the Carlsbad Canyon, which is located approximately 0.25 miles downcoast of the Station and 1.2 miles offshore.

The local distribution of species is determined by the offshore geomorphology. Ambrose et al. (1989) found that hard substrate constituted only 14 percent of the offshore habitat in San Diego County. Most of this area was offshore of Point Loma and La Jolla, with small areas offshore of Encinitas and Carlsbad. Stewart (1991) found that patchy rocky subtidal outcroppings and ledges occur from the south end of Carlsbad State Beach to Moonlight Beach, from south Encinitas to Cardiff State Beach, and from Del Mar to Torrey Pines. Most of the beaches in San Diego County are underlain with hard substrate, which becomes exposed with the loss of sand habitat from beach erosion.

A side-scan sonar mapping survey was conducted on September 20, 2000, by Coastal Frontiers Corporation, to identify the seafloor substrate types in the vicinity of the Lagoon entrance. The sonar survey was conducted with sonar unit operating at a frequency of 500 kHz and a swath width of 164 feet. The side-scan sonar data was combined with bathymetric data to generate a seafloor map showing the reefs and sand bottom habitats in the project area. The maps from this survey have been digitized and plotted in Figure 4.1-2. This map delineates reefs as “low relief” with elevations less than or equal to 2 feet and “high relief reef” with elevations greater than 2 feet. A prior survey in this region, conducted during the SANDAG beach replenishment surveys (MEC 2000) defined high relief reefs in the area as having a relief greater than 3 feet. This survey, however, did not include the current area of interest that is 2,000 feet upcoast and downcoast of the Lagoon entrance.

The hard substrate in the vicinity of the Lagoon entrance was also identified by an aerial survey on October 31, 2001. This survey was made to classify substrate in the shallow subtidal zone at depths less than 20 feet that were not mapped by the sonar surveys. The aerial survey was conducted with a SpecTerra Digital Multispectral Video (DMSV) multispectral instrument fitted with color filters to maximize water penetration and detection of subsurface substrate. The map of hard substrate resulting from this survey is shown in Figure 4.1-3. This figure shows the complex set of reefs and sand channels that are found in the area upcoast of the Lagoon entrance.

The description of existing biological resources at the project site has come from a variety of sources. These include a biological survey conducted for the Applicant during October and November 2000 (Hofman Associates 2001) and aerial multispectral imagery acquired by Ocean Imaging on August 27 and October 31, 2001. The EIR conducted for the SANDAG beach replenishment project (SANDAG 2000) describes the biological resources at sites just upcoast and downcoast of the Agua Hedionda jetty. The information on kelp resources in the region comes from aerial surveys conducted by Dr. Wheeler North of the California Institute of Technology and MBC Applied Environmental Sciences (MBC 2001). The geographic information system (GIS) database for kelp resources has been maintained with support from Southern California Edison (Deysher et al. 1995).

INSERT FIGURE 4.1- 2

INSERT FIGURE 4.1- 3

The intertidal and shallow subtidal reef habitats in the project area are strongly influenced by the shifting sands in the region. The sand moves in response to wave action and has a seasonal onshore and offshore migration with the sand moving into deeper water during the winter when waves are generally larger. Many of the low-lying reefs are periodically buried by the sand and the biological communities on these reefs are much less diverse than communities on higher relief reefs (MEC 2000). The species on the low-lying reefs are dominated by species that can survive extended periods of sand burial such as the algae (*Zonaria farlowii)*.

The offshore kelp bed communities can also be disturbed by large amounts of sand movement. The sand can bury the holdfasts of the plants and cover the hard substrate that is required for the recruitment of new individuals (Devinny and Volse 1978). Moderate amounts of sand scour on the reefs, however, may be helpful to kelp populations by removing other plant and invertebrate species that compete for space on the reefs (Patton et al. 1994).

Another important factor limiting kelp populations is turbidity, which can reduce light levels on the bottom. The lower depth limit of kelp is set by light limitations and persistent turbidity in the water will restrict the depth distribution of kelp. In addition, the successful recruitment of new adult kelp plants is dependent on sufficient levels of nutrients and light to stimulate fertility of the microscopic gametophyte stage of the *Macrocystis* life cycle (Deysher & Dean 1984).

Subtidal Habitat

The primary biological communities in the local subtidal region are invertebrate populations occurring on the sandy substrate and the kelp beds that occur on the hard substrate. Surfgrass beds also occupy hard substrate in the shallow subtidal and intertidal. The surfgrass communities will be discussed in the section on intertidal habitats because they are the most important resource in this habitat.

Kelp beds in California are a well-studied resource and have been shown to be an important habitat for a number of fish and invertebrate species (Foster & Schiel 1985, Dayton 1985). Kelp beds also provide a food supply for marine birds and mammals. Cormorants are the birds most closely associated with the kelp beds, but gulls, terns, and pelicans also utilize fish schooling near the canopy. Mammals such as sea lions, seals, and whales use kelp beds as foraging areas.

The three local kelp beds have been a fairly stable resource, but were severely impacted by the 1998 El Niño period and have not recovered to the extent of other kelp beds in the region. The beds are occasionally harvested by ISP Alginates (formerly Kelco Company), but are not an important resource for the company. Most of the beds harvested for alginates occur south of Carlsbad and the beds offshore of Agua Hedionda are harvested once every two or three years (Dale Glantz 2001). The beds are also a resource for sport fishers; sport-fishing boats from Oceanside Harbor specifically utilize the beds as focal points for their fishing activities.

The shallow subtidal sand community is subject to frequent disturbance due to waves and sand movement. The frequency of this disturbance declines further offshore in deeper water. The seasonal movement of sand inshore during the summer months and offshore during the winter can also bury existing habitat and associated fauna. The spatial and temporal distributions of organisms within this habitat vary greatly due to the dynamic nature of the environment. Benthic invertebrates in this habitat are well adapted to shifting sediments and turbidity, with suspension feeders being the dominant group.

The sand bottom communities have been fairly well documented in the nearshore zone offshore of Scripps Institute of Oceanography (Fager 1968, Davis & Van Blaricom 1978, Oliver 1980). Common benthic macroinvertebrates found in local sand bottom habitats include two crustaceans (*Megaluropus sp*. and *Leptocuma forsmani*) and the sea spider (*Callipallene sp*.). The polychaete (*Apoprionospio pygmaeus*) and the nemertean (*Carinoma mutablis*), are common infaunal organisms in this community. Overall, polychaete worms were the most abundant group followed by amphipods and other arthropods (Hofman Planning Associates 2001). This assemblage of organisms is widespread throughout southern California (Chambers 1999).

Data to develop historical records for sand bottom communities are not available for most areas of southern California. There are anecdotal reports of some communities, such as sand dollar beds, being more abundant in the past, but these changes are not well supported. There is no evidence that the sand bottom community in the project area has undergone any significant changes in recent times.

Subtidal reefs form a complex habitat offshore of the entrance to Agua Hedionda Lagoon. The stability of this habitat depends on its height above the surrounding sand substrate. Low-lying substrate in shallow water is subject to frequent sand scour and has a depauperate invertebrate community. Higher relief reefs support a more diverse invertebrate assemblage that includes sea fans (*Muricea californica* and *M. fruticosa*), ornate tube worms (*Diopatra ornate*), the reef building polychaete (*Phragmatopoma californica*), snails (*Kelletia kelletii*), red and purple sea urchins (*Strongylocentrotus franciscanus* and *S. purpuratus*), hermit crabs (*Pagurus spp*.), barnacles (*Balanus pacificus*), lobsters (*Panulirus interruptus*), sea stars (*Pisaster giganteus* and *P. ochraceus*), and tunicates (*Styela montereyensis*).

Local populations of *Macrocystis* require hard substrate for the attachment of individual plants. Populations in the Santa Barbara region have been found growing on sandy substrate, but no populations have been reported growing on sandy substrate south of Los Angeles since the early 1950s. The nearshore substrate in the vicinity of Agua Hedionda jetty consists of a system of reefs interspersed with many sand channels. The inshore reefs have vertical relief varying from 1 to 5 feet (Hofman Planning 2001), while the offshore reefs in water depths (30 to 50 feet) suitable for *Macrocystis* have a lower relief ranging from 0.5 to 3 feet. It appears that sand scour is a dominant factor regulating the size of *Macrocystis* populations in this region.

The local kelp beds can undergo dramatic fluctuations in size due to a variety of factors including winter storms, warmer than normal ocean temperatures due to El Niño events, and localized episodes of grazing by a number of herbivores, especially sea urchins (*Strongylocentrotus spp*). The average life span of a plant in a kelp bed is on the order of 2.5 years (Foster & Schiel 1985), so plants have to be renewed within the kelp bed on a frequent basis to maintain the population.

Three persistent kelp beds (*Macrocystis pyrifera*) are found in the vicinity of the Agua Hedionda jetty (Figure 4.1-4). The North Carlsbad bed is approximately 1.2 miles to the north, the Agua Hedionda bed extends directly north of the north jetty, and the Encina bed is 0.9 miles to the south. Distribution data on these beds are based on annual aerial surveys conducted by Dr. Wheeler North of CalTech and MBC Applied Environmental Sciences. The annual maps have been compiled into a GIS database that can be used to compare various aspects of kelp population dynamics in southern California (Deysher et al. 1995). Figure 4.1-4 shows the persistence of kelp within these beds as represented by the number of years that kelp canopy was present in different areas. The Encina bed has the highest average persistence of the three beds.

INSERT FIGURE 4.1- 4

Figure 4.1-5 shows the history of the size of the Agua Hedionda bed from 1967 to 2002. This bed, along with the other beds in North San Diego County, has shown large fluctuations in size with major declines during the El Niño periods of 1982, 1992, and 1998. All of the north San Diego County beds reached near record areas during the La Niña event of 1989. The majority of these beds have recovered from the 1998 El Niño event, but the Agua Hedionda kelp bed has recruited few new plants. The reason for this apparent lack of recovery is not known.

The subtidal habitats of the open coast in the project area support a large number of fish species. Many of the fish species live in both open coast and Lagoon habitats and transit through the jetty entrance.

The most common fish in sandy open coast habitats in northern San Diego County is the speckled sand dab (*Citharichthys stigmaeus*). Other fishes commonly found in this habitat include California halibut (*Paralichtys californicus*), bat rays (*Myliobatus californica*), and shovelnose guitarfish (*Rhinobatus productus*). Northern anchovy, jack mackerel (*Trachurus symmetricus*), and Pacific bonito (*Sarda chiliensis*) are commonly encountered in the water column beyond the surfzone (SANDAG 2000).

Economically important fish are those species that have commercial or sport fishing value or those species that provide food for these species. Table 4.1-1 provides a list of commercially important fish in northern San Diego County with the landings for CDFG Blocks 801, 821, and 822 (Oceanside to Solana Beach) for the period from 1994 to 1998. Other species important for sport fisheries and as forage include kelp bass (*Paralabrax clathratus*), barred sand bass (*Paralabrax nebulifer*), sargo (*Anisotremus davidsonii*), walleye surfperch (*Hyperprosopon argenteum*), corbina (*Menticirrhus undulatus*), jacksmelt (*Atherinopsis californiensis*), topsmelt (*Atherinops affinis*), queenfish (*Seriphus politus*), salema (*Xenistius californiensis*), and blacksmith (*Chromis punctipinnis*).

Intertidal Habitat

The local intertidal habitat on the open coast is dominated by sand, but there are extensive regions of low-lying hard substrate that can support biological communities. These communities are dominated by a specialized group of plants that can either recruit and grow quickly on the newly exposed rock surfaces (*Ulva* and *Enteromorpha*) or species such as Zonaria and Corallina that tolerate a moderate amount of sand scour and burial. Surfgrass (*Phyllospadix spp*.) can also tolerate a moderate amount of sand scour and burial and is a dominant plant in this region. The rock riprap of the jetty

INSERT FIGURE 4.1- 5

Table 4.1-1. Summary of Landings of Important Commercial Fish Species in California Fish Blocks 801, 821, and 822 (Oceanside to Solana Beach), 1994 to 1998

Fishery	Species	Average Volume (pounds)	Value
Anchovy	*Entrails mordax*	187,550	$11,543
Barracuda	*Sphyraena argentea*	118	$62
Bonito	*Sarda chiliensis*	18,194	$4,665
Croaker	*Genyonemus lineatus* *Umbrina roncador*	123,108	$72,281
California Halibut	*Paralichthys californicus*	3,789	$10,684
Lingcod	*Ophiodon elongatus*	94	$465
Mackerel	*Tracharus symmetricus* *Scomber japonicus*	3,810,192	$244,960
Rockfish	*Sebastes spp.*	157,388	$59,266
Sablefish	*Anoplopoma fimbria*	985	$876
Sardine	*Sardinops sagax*	214,546	$11,011
Seabass	*Atractoscion nobilis*	61	$163
Shark	*Various species*	18,155	$17,297
Sheephead	*Semicossyphus pulcher*	18,591	$53,257
Sole	*Various species*	1,590	$1,164
Swordfish	*Xiphias gladius*	7,242	$27,391

structure itself provides substrate for a variety of both plant and invertebrate species. The plant community is dominated by the feather boa kelp (*Egregia menziesii*). Mussels (*Mytilus spp*.) dominate the invertebrate community.

The sandy beaches also provide an important spawning area for the California grunion (*Leuresthes tenuis)* and roosting and feeding areas for a variety of shorebirds. Shorebirds can both probe the sand for invertebrates or pick invertebrates from the kelp and surfgrass that washes onshore.

The surfgrass beds are the most ecological and economically important intertidal community. A total of 80 to 100 acres of surfgrass (*Phyllospadix)* is estimated to occur along the North San Diego County coastline (SANDAG 2000). Surfgrass beds are important nursery areas for juvenile California spiny lobsters (*Panulirus interruptus*), (Leet et al. 1992). Juvenile lobsters usually spend their first one to two years in nearshore surfgrass beds and eelgrass beds (CDFG 1993). These young lobsters molt about 20 times in the first year and about four times during their second year. After molting, they are sensitive to predation and physical damage, and the surfgrass beds provide an important refuge. As they grow larger, they molt less often and move offshore to rocky crevices in depths up to 210 feet.

Grunion are regulated as a sport fish by the CDFG and they are an important food fish for many commercial and sport fisheries. This species is common south of Point Conception to Magdalena Bay, Baja, California in nearshore waters from the surf to a depth of 60 feet. Grunion spawn on sandy beaches just after full and new moons from March to August. Spawning typically takes place on long, gently sloping beaches with moderately fine grain size. The eggs remain in the sand for a period of about 10 days until they hatch when the nesting site is washed by waves on the next extreme high tide (Fritzsche et al. 1985).

Human use of the sandy beaches in southern California has significantly decreased their value as a shorebird foraging area. Shorebirds avoid areas of high human activity and have less chance to forage in these areas. The Project area has very high and constant recreational use and subsequently little shorebird feeding activity.

The open coast sandy beaches in this region are a rigorous environment of constantly shifting sand that provides minimal habitat structure because the wave energy keeps the sand in suspension most of the time (Chambers Group 1990). This rigorous environment results in a depauperate invertebrate community dominated by beach hoppers (*Orchestodea spp*.), isopods (*Tylos punctatus*), mole crabs (*Emerita analoga*), opossum shrimps (*Archaeomysis maculata*), polychaete worms (*Euzonus mucronata*), bean clams (*Donax gouldi*), and Pismo clams (*Tivela stultorum*) (Hofman Planning Associates 2001).

There are few records to allow a detailed description of long-term changes of any of the populations found on the sandy beach community. There are anecdotal observations that grunion populations are decreasing and there is currently a project in San Diego to determine if the practice of cleaning drift kelp from the beaches in the city is negatively impacting grunion eggs and the resulting grunion population (Project Pacific 2001).

Populations of surfgrass are dependent on the presence of hard substrate onto which the plants can attach. The plants are attached to the rock substrate by a woody rhizome to which the long thin leaves are attached. The plant colonizes new substrate primarily by elongation of the rhizome structure. Growth of this rhizome is fairly slow, on the order of 3.5 inches per year (Ramirez-Garcia et al. 1998). The plants can be found in turbulent wave swept areas and they have a number of specialized features to resist being swept from the rocks.

Surfgrass beds can occur from depths of 0 to –20 feet mean lower low water (MLLW). Both vegetative shoot density and number of flowering shoots decrease with increasing depth, indicating that light is a limiting resource for both growth and reproduction (Williams 1995). The plant is considered to be a stress tolerant species and can survive in very sandy environments. Obrien & Littler (1977) observed that surfgrass appeared to increase in cover relative to other organisms in the presence of sand. The species has a number of features that allow it to persist in sandy habitats, including fibrous sheaths that provide protection from sand abrasion and the ability of the rhizomes to persist for many months under wet sand (Cooper & McRoy 1988, Stewart 1989). The SANDAG Beach Replenishment Monitoring Studies have found that surfgrass can survive burial by 2 feet of sand for up to two years (AMEC 2003). However, the duration and depth of burial that will cause mortality of the plant has not been studied. Incremental burial has been reported to affect blade growth. Surfgrass recovery rates are slow (three to five years) when recovering from removal of the rhizome mat, but may be quicker when the rhizome remains intact.

Substrate suitable for surfgrass habitat offshore of the Agua Hedionda jetty was mapped with side-scan sonar by Coastal Frontiers Corporation on September 20, 2000. The results of this survey are summarized in Figure 4.1-2. This sonar survey was compared to an aerial survey made with a DMSV that could distinguish the reefs from sand in the shallow subtidal. The aerial imagery clearly shows the structure of the nearshore reef system with many sand channels (Figure 4.1-3). The minimum mapping unit used for the Coastal Frontiers sonar survey appears to be larger than the average reef size and only the largest sand channels were shown in this survey.

A series of diver surveys was conducted to ground-truth the sonar studies and to obtain additional data on the intertidal and subtidal communities in the project area. The locations of the diver transects and survey locations are shown in Figure 4.1-6. The diver surveys showed that the relief of reefs in the area ranged from basement rock barely protruding above the sand layer to reefs with 5 feet of relief. The majority of the reefs appear to have a relief of about 2 feet. A total of 10 transects was conducted in the nearshore zone upcoast of the jetty. The average reef cover from these transects was determined to be 80.5 percent. Red algal turf communities characteristic of sand scoured habitat comprised 47 percent of the reef surfaces and *Phyllospadix torreyi*

INSERT FIGURE 4.1- 6

comprised 21.1 percent. The kelps, *Egregia menziesii* and *Eisenia arborea*, comprised 15.8 percent of the cover. The report did not discuss how the positions of the transects were chosen or whether they could be considered to be randomly distributed over the region.

The positions of the surfgrass populations located in the vicinity of the proposed jetty restoration footprint were mapped using high-resolution multispectral imagery from aerial surveys conducted on August 22, 2001 and October 6, 2002. The images were collected with digital multispectral instruments that record images in four distinct spectral bands. The 2001 flight was flown with a DMSV instrument and the 2002 flight used a SpecTerra Digital Multispectral Camera (DMSC). The main difference between the two instruments is that the DMSC has 12 bit spectral resolution as compared to the 8 bit resolution of the DMSV. The 12 bit resolution provides better water depth penetration and permits both the land and the water portions of the imagery to have adequate contrast for identifying objects. The images for these surveys were acquired at an altitude of 2,500 feet and had a pixel resolution of approximately 1.6 feet. The spectral bands selected for these flights were chosen to have the maximum water penetration to detect the subtidal surfgrass populations and discriminate them from the other algal populations on the reefs. The surfgrass populations were ground-truthed with a diver survey on August 30, 2001, and an intertidal survey during a low tide on January 30, 2002. Both of these surveys used autonomous Global Position Survey (GPS) to identify the prominent features seen in the imagery and to identify the shoreward extent of the surfgrass beds.

Figure 4.1-7 shows the surfgrass populations observed in the 2001 and 2002 surveys. Two large populations in deeper water that were not mapped in the 2001 survey were observed in 2002. It is unlikely that these populations recruited in the time period between the surveys because surfgrass plants are rather slow growing and increase in size by extending their rhizomes across the rocky substrate. It is more likely that turbidity or breaking waves obscured these populations from observations in the 2001 survey. The populations observed in 2001, but not seen in 2002, could have been buried by sand during the 2002 survey. This is especially true of the populations at the shoreward extent of the range. The populations in deeper water, however, are on fairly high relief reefs and were most likely not observed due to lower water clarity in these areas during the 2002 survey. The best estimate of surfgrass populations in this region is a composite of the two surveys.

INSERT FIGURE 4.1- 7

The surfgrass populations identified in the aerial surveys correspond well with the surfgrass observed on diver transect surveys made in the immediate vicinity of the jetty entrance in October 2000 (Hofman Planning Associates 2001). The locations of the transects used for the diver surveys are shown in Figure 4.1-8. A boat survey was also made during this time period when water visibility was extremely good and the outlines of the surfgrass beds could be seen from the surface. The offshore beds outlined in the boat surveys show good correspondence with the aerial imagery. The surfgrass in the entrance channel, however, showed differences between the surveys. The large bed observed in the center of the channel during the 2001 aerial survey was not in seen in either the 2002 aerial survey or the 2000 boat survey. Ground truth dives associated with the 2001 aerial survey confirmed the presence of this population. It appears that this population may be periodically covered and uncovered by sand in the entrance channel. The large bed indicated by the boat survey on the north side of the south jetty appears to have included some scattered individual surfgrass plants that were not dense enough to be observed by the aerial sensor. A small to medium sized bed was observed in this area during both the 2001 and 2002 aerial surveys.

Fish populations that can be abundant in San Diego surfgrass communities include topsmelt, blacksmith, walleye surfperch (*Hyperprosopon argenteum*), señorita, opaleye, and blackperch (DeMartini 1981). Garibaldi, perch, and barred sand bass were found to be common in surfgrass beds off Cardiff and Solana Beach (SANDAG 2000). The primary economic importance of these species is as forage for various sport fishes. Some of the species, especially the perches, are important sport fishes for surf fishers.

The California grunion (*Leuresthes tenuis*) is common south of Point Conception to Magdalena Bay, Baja, California, in nearshore waters from the surf to a depth of 60 feet. As previously indicated, grunion travel from their habitat in nearshore waters to spawn on sandy beaches just after full and new moons from March to August. Grunion in San Diego County typically spawn on long, gently sloping beaches with moderately fine grain size.

Lagoon Habitat

The biological communities in Agua Hedionda Lagoon benefit from full tidal exchange with the ocean. The three basins of the Lagoon have a total surface area of 350 acres with a maximum depth of approximately 30 feet. Most of the bottom is covered by a relatively firm sand-silt mixture with silt being predominant in quiescent regions and

INSERT FIGURE 4.1- 8

sand in areas of higher current velocity. Extensive eelgrass beds (*Zostera marina*) are located throughout the shallower areas of the Lagoon with silty/sandy sediments (Merkel and Associates 2004b). Beds of *Sargassum muticum*, a large brown seaweed introduced from Japan, are common along the rocky riprap shore of the Outer Lagoon near the entrance channel. Another introduced species, *Caulerpa taxifolia*, has been found in the Inner Lagoon and has been the subject of an extensive eradication effort. This semi-tropical green alga has invaded extensive areas of the Mediterranean where it has displaced a variety of plant and animal species and totally monopolized large areas of nearshore habitat (Meinesz et al. 1993, Boudouresque et al. 1995, Bellan-Santini et al. 1996, Jousson et al. 2000). There is concern that this species will displace eelgrass within the Lagoon habitat and also move out of the Lagoon into nearshore habitats where it could potentially displace surfgrass and possibly even kelp species. The rate at which this invasion would occur, however, is uncertain based on observations that *Caulerpa taxifolia* did not significantly impact a seagrass bed in Menton Bay (France) during an eight-year period of observation (Jaubert et al. 1999).

The eelgrass beds provide food and shelter for many species of marine invertebrates and fishes. The beds serve as a nursery area for many juvenile fishes including California halibut and barred sand, which have important commercial and sport fish value. Eelgrass beds also function as critical foraging centers for seabirds, such as the endangered California least tern, that seek out baitfish attracted to the eelgrass cover. Eelgrass beds are important providers to the detrital food web as the decaying plant material is consumed by many benthic invertebrates and reduced to primary nutrients by bacteria.

The eelgrass communities in Agua Hedionda Lagoon are larger than the other lagoons in San Diego County because the Lagoon entrance has remained open to full tidal flushing for over 40 years. Many of the other coastal lagoons in the county experience buildups of sand in their entrance channels that completely block tidal exchange. These closures produce large fluctuations in water salinity, temperature, and oxygen content that can kill the eelgrass populations.

The shallow nature of the three lagoon basins also permits the development of extensive eelgrass beds. The lower limit of eelgrass populations is set by light limitation and the lagoon basins are generally shallower than the lower limit set by light.

The dredging required to keep the Lagoon open to the ocean has mixed effects on the eelgrass populations. The full tidal flushing that results from the dredging operations permits the development of eelgrass populations in all three Lagoon basins. However, some populations are physically removed during the dredging operations and there are also indirect turbidity effects during dredging that can reduce growth of the plants.

Well-developed beds of eelgrass are found in all three lagoon basins (Figure 4.1-9; Merkel and Associates 2004b). In April 2001, after the dredging of the Outer Basin, eelgrass covered a total of 7.6 acres in the Outer Basin with a mean shoot density of 362.4 per square meter (Merkel 2001). These populations experience significant fluctuations in size in 1999 and 2000. In the 1999 survey, an area of 6.6 acres was reported, and 10.4 acres were reported in the 2000 survey, made immediately before the dredging operations in the Outer Basin (Merkel 2000).

Caulerpa taxifolia was first discovered in Agua Hedionda Lagoon on June 12, 2000 and covered a maximum of 0.3 acres before eradication efforts began in the summer of 2000 (Merkel and Woodfield 2003). Intensive monitoring efforts in all three lagoon basins, along the entrance channel, and in the nearshore region in the vicinity of the Lagoon entrance have detected *Caulerpa* populations only in the Inner Basin (Figure 4.1-10). The eradication efforts appear to be successful and the last *Caulerpa* population was detected in the summer of 2002 (Merkel and Associates 2002a,b,c; 2003a,b; 2004a). *Caulerpa* has not been declared eradicated from the Lagoon as extensive diver surveys continue to monitor the Lagoon.

A total of 104 species of fish have been reported as juveniles or adults from Agua Hedionda Lagoon (SDG&E 1980). A total of 68 species were collected by nekton sampling in the Lagoon. These catches were dominated by topsmelt, deepbody anchovy, and slough anchovy that comprised more than 77 percent of the catch. Catch was highest in the Inner Lagoon where 40 species were collected. In this area of the Lagoon, the same three dominant species accounted for more than 86 percent of the overall catch. In the Middle Lagoon, the catch again included 40 species with three species (topsmelt, shiner surfperch, and California grunion) together comprising 81 percent of the catch. In the Outer Lagoon a total of 39 species were collected in the nekton sampling. Four species (topsmelt, California grunion, walleye surfperch, and California halibut) comprised more than 77 percent of the catch. A total of 88 species of fish were collected in the impingement sampling for the cooling water intake. This number included 36 species not collected in the nekton sampling. The additional species were typically marine species not collected in the nekton sampling. Five

INSERT FIGURE 4.1- 9

INSERT FIGURE 4.1- 10

species (deepbody anchovy, topsmelt, northern anchovy, queenfish, and shiner perch) comprised more than 72 percent of the overall impingement collections. In addition to the juvenile and adult fish, a total of 36 species of fish were also collected as eggs and larvae in plankton sampling within the Lagoon. All of these species were also collected as juveniles or adults within the Lagoon. The egg collections were dominated by silversides, gobies, and anchovies (Hofman Planning Associates 2001).

Marine Mammals, Birds, Turtles, and Other Special Status Species

Several species of marine mammals occur in nearshore waters in the vicinity of the jetty restoration site. California sea lions (*Zalophus californicanus*) are frequently seen hauled out on the offshore buoys marking the fuel-unloading site for the Encina power plant. Harbor seals (*Phoca vitulina*) also frequent the nearshore zone. Common dolphins (*Delphinus delphis*) and bottlenose dolphins (*Tursiops truncates*) occur in the surfzone and in offshore water.

Several non-sensitive marine birds utilize the study area for foraging, nesting, and roosting. These species are documented in the Batiquitos Lagoon Enhancement Project EIR/EIS and the San Diego Regional Beach Sand Project EIR/EA (SANDAG 2000).

Information on the sensitive marine birds in the project area was obtained from a review of existing literature, interviews with local experts (John Martin, USFWS, pers. comm.), local agencies, and a search of the California Natural Diversity Database (CNDDB). The sensitive species that have the potential to occur within the project area are: California brown pelican (*Pelicanus occidentalis californicus*), California least tern (*Stern antillarum browni*), Western Snowy Plover (*Charadrius alexandrinus nirvosus*), Belding's savannah Sparrow (*Passerculus sandwichensis beldingi*), and the Coastal California gnatcatcher (*Polioptila californica californica*).

California Brown Pelican (Pelicanus occidentalis californicus)

The California brown pelican is a state and federally listed endangered species. The California brown pelican is one of California's largest marine birds. They capture fish by plunge diving schooling fish near the ocean surface. They feed on northern anchovy, pacific sardine, and pacific mackerel (Thelander 1994). Nesting usually begins in spring, although timing may vary significantly from colony to colony. Females generally lay three eggs per nest, with an average fledging rate less than 1.5 fledged per successful nest (Thelander 1994). Birds surviving to adulthood can live 20 to 30 years.

Brown pelicans have been observed frequently at Batiquitos Lagoon foraging, bathing and resting (Batiquitos EIR). Brown pelicans may utilize the study area for foraging and the shoreline as roosting habitat; however, they do not nest within Agua Hedionda Lagoon (Page 2001).

California Least Tern (Stern antillarum browni)

The California least tern is a state and federally listed endangered species. Least terns are present in nearby wetlands and lagoons during the breeding season, April through September. Nesting colonies are usually located where there is a seasonal abundance of small fish (Thelander 1994). Colonies usually contain 30 to 50 nesting pairs. Least terns are known to forage close to their nesting sites but may extend their foraging habitat up to 15 miles of their nesting site. This area is referred to as their potential foraging area (John Martin, USFWS, pers. com). Batiquitos Lagoon supports nesting least tern colonies (Batiquitos EIR). However, there are no known nesting colonies within the project site at Agua Hedionda Lagoon, although the study area may potentially be used for foraging.

Western Snowy Plover (Charadrius alexandrinus nirvosus)

The western snowy plover is federally listed as threatened. The plover's breeding range extends between southern Washington and Baja, California. The breeding season lasts from March to September and some plovers may produce as many as three broods in succession during these months (Thelander 1994). Plovers have been observed frequently within the mud flat habitat at the nearby Batiquitos Lagoon. Several locations at the Batiquitos Lagoon are utilized for nesting by the snowy plover (Batiquitos EIR). This species may be periodically present along the Agua Hedionda project beach, but is not known to breed within the study area (John Martin, USFWS, pers. com).

Belding's Savannah Sparrow (Passerculus sandwichensis beldingi)

The Belding's savannah sparrow is a state listed endangered species. This species is nonmigratory, and lives all year in coastal salt marshes foraging on nearby mud flats, shorelines and rock jetties. Breeding season for the Belding's savannah sparrow is from April to July. Nesting pairs have been recorded at Batiquitos Lagoon within pickleweed marsh habitat that appeared healthy and not stressed from freshwater inundation (Batiquitos EIR). This species may be present within the inner Agua Hedionda Lagoon (Page 2001).

Coastal California Gnatcatcher (Polioptila californica californica)

The Coastal California gnatcatcher is federally listed as threatened. They are insectivorous, gleaning insects, spiders, and other arthropods from California buckwheat and various spies of coastal sage scrub vegetation. Breeding season is from February to July. Gnatcatchers do not venture far from their home range, which runs along the coastal areas from Southwestern California to Northwest Baja California (Thelander 1994). The Coastal California gnatcatcher is present within the inner Agua Hedionda Lagoon.

Tidewater Goby (Eucyclogobius newberryi)

The Tidewater Goby (*Eucyclogobius newberryi*), is a federally listed species found in shallow, brackish water areas in estuaries from northern California to Bolsa Chica Lagoon. A member of the family Gobiidae, the Tidewater Goby is the only species in the genus Eucyclogobius and is almost unique among fishes along the Pacific coast of the United States in its restriction to waters with low salinities in California's coastal wetlands. All life stages of Tidewater Gobies are found at the upper end of lagoons in salinities less than ten parts per thousand. Although populations of Tidewater Goby are not presently found in Agua Hedionda Lagoon, the Lagoon has been listed as critical habitat for this species by the USFWS.

Abalone (*Haliotis spp.*)

Two species of abalone are listed in the CNDDB as Special Animals in California. The white abalone (*Haliotis sorenseni*), the first marine invertebrate listed as a federally endangered species, was listed on June 28, 2001. This species generally occurs in water depths between 66 and 200 feet and therefore occurs outside the depth range of the proposed Project. The black abalone (*Haliotis cracherodii*) is candidate for federal listing. This species occurs in shallow subtidal and intertidal rocky habitats throughout southern California. The population of this species has been severely reduced by a wasting disease caused by a bacteria-like organism. The shallow subtidal reefs in the project area appear to be potential habitat for this species, but there have not been any recent reports of individuals of this species in the area. Dispersal of all abalone species is quite limited (Tegner and Butler 1985, Hobday and Tegner 2000) and recruitment of new individuals into this area would be very limited because of the lack of nearby adult populations.

Sea Turtles

Several species of sea turtles are distributed throughout the eastern Pacific and off the California coast. These species include the green sea turtle (*Chelonia mydas),* leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), and the olive ridley sea turtle (*Lepidochelys olivacea*). Fairly large populations of the green, loggerhead, and olive ridley sea turtles occur in the southern portion of San Diego Bay where they appear to be attracted to the warm-water discharge of the Duke Energy power plant. Population estimates for green sea turtles in San Diego Bay range from 50 to 72 turtles, the majority of which appear to be concentrated in the power plant effluent channel (McDonald et al. 1994). Sea turtles typically require an ambient water temperature range of approximately 46° to 90° F.

The warm-water discharge of the Station in the vicinity of the jetty project could provide a preferred habitat for these species. However, no increased abundance of sea turtles in this area has been reported. Sightings of sea turtles are very rare in southern California.

4.1.2 Regulatory Setting

Local Coastal Plan

The Carlsbad Coastal Zone has been segmented into four distinct planning areas. The jetty restoration project is in the Agua Hedionda Local Coastal Plan (LCP). This plan recognizes the unique environmental status of the Lagoon and designates the entire Agua Hedionda Plan area as a “special treatment area”. The plan provides broad guidelines to shape the future development within this area.

The major goals of the plan relevant to the biological resources of the project area are summarized as follows:

- Protect and conserve natural resources, fragile ecological areas, unique natural assets, and historically significant features of the community;
- Preserve natural resources by protecting fish, wildlife, and vegetation habitats; retain the natural character of waterways, shoreline features, hillsides, and scenic areas; safeguard areas for scientific and educational research; respect the limitations of our air and water resources to absorb pollution; and encourage legislation that will assist in preserving these resources.

Multiple Habitat Conservation Program

The Multiple Habitat Conservation Program (MHCP) is a comprehensive habitat conservation planning process that addresses multiple species needs and the preservation of native vegetation communities for the cities of Carlsbad, Encinitas, Escondido, Oceanside, San Marcos, Solana Beach, and Vista, California. This program is one of three subregional habitat conservation planning programs in the San Diego region. SANDAG is coordinating the MHCP for the North County cities.

The MHCP, along with other habitat plans being prepared throughout southern California, contribute to the preservation of biodiversity by developing a coordinated habitat preserve system. The MHCP is recognized as a subregional plan for the purposes of the Natural Community Conservation Planning Act (NCCPA) and will be implemented through individual subarea plans prepared by each local jurisdiction, and potentially by other public entities. The MHCP will allow local jurisdictions to maintain land use control and development flexibility by planning a regional preserve system that can meet future public and private project mitigation needs. The subregional MHCP does not impose major new restrictions on land use. Rather, the plan is designed to streamline procedures for review and permitting of projects.

The Multiple Habitat Management Plan (Carlsbad) is focused on preserving eight vegetation types, including marsh and estuarine wetlands. The covered species for this plan include a variety of invertebrates, birds, and plants that are found in the vicinity of Agua Hedionda Lagoon and use the Lagoon as habitat (Table 3-6 of MHMP for Carlsbad AMEC 2003). The analysis of the impacts of the jetty restoration has taken the goals of this program into account and has considered each of the covered species for this plan.

California Endangered Species Act

The California Endangered Species Act (CESA) generally parallels the main provisions of the Federal Endangered Species Act and is administered by the California Department of Fish and Game (CDFG). Under CESA, the term “endangered species” is defined as a species of plant, fish, or wildlife that is “in serious danger of becoming extinct throughout all, or a significant portion of its range” and is limited to species or subspecies native to California. The CESA prohibits the “taking” of listed species except as otherwise provided in State law. Unlike the Federal ESA, CESA applies to species petitioned for listing.

Under CESA, the CDFG has the responsibility for maintaining a list of threatened and endangered species (California Fish and Game Code 2070). The CDFG also maintains a list of "candidate species," which are species that the CDFG has formally noticed as being under review for addition to the state's list of threatened or endangered species. The CDFG also maintains lists of "species of special concern," which serve as "watch lists." Pursuant to the requirements of CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any state-listed endangered or threatened species may be present in the project area and determine whether the proposed project will have a potentially significant impact on such species. In addition, the CDFG encourages informal consultation on any proposed project that may impact a candidate species.

Marine Life Management Act

The Marine Life Management Act (MLMA) was established to ensure the conservation, sustainable use, and restoration of California's marine life. This includes the conservation of healthy and diverse marine ecosystems and marine living resources. To achieve this goal, the MLMA calls for allowing and encouraging only those activities and uses that are sustainable. Although most of the MLMA is devoted to fisheries management, it also recognizes that non-consumptive values such as aesthetic, educational, and recreational are equally important. Unlike previous law, which focused on individual species, the MLMA recognizes that maintaining the health of marine ecosystems is important in and of itself. The MLMA also holds that maintaining the health of marine ecosystems is key to productive fisheries and non-consumptive uses of marine living resources.

A primary goal of the MLMA is to provide for sustainable fisheries. A sustainable fishery is defined in the MLMA as one in which fish populations are allowed to replace themselves. The MLMA recognizes that populations of marine wildlife may fluctuate from year to year in response to external environmental factors, such as climate and oceanic conditions. Unlike traditional definitions of sustainability in fisheries, a key feature of the MLMA definition calls for maintaining biological diversity.

Endangered Species Act of 1973

The Endangered Species Act provides a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved and provides a program for the conservation of such endangered species and threatened species.

Section 7 of the Endangered Species Act directs all Federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the USFWS or the National Marine Fisheries Service (NOAA Fisheries), to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 applies to management of Federal lands as well as other Federal actions that may affect listed species, such as Federal approval of private activities through the issuance of Federal permits, licenses, or other actions.

All federally listed threatened and endangered species have been considered in the review of this project.

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) require that Essential Fish Habitat (EFH) be identified for federally managed fishery species and the implementation of measures to conserve and enhance this habitat. These amendments require federal agencies to consult with the National Marine Fisheries Service on activities that may adversely affect Essential Fish Habitat. There are many situations where designated Essential Fish Habitat overlaps with the habitat of species listed as threatened or endangered under the Endangered Species Act. The proposed Project, therefore, could affect both a listed species and its designated critical habitat and adversely affect EFH. In this case consultation would be required under both Section 7 of the Endangered Species Act and Section 305(b) of the MSA.

The Navy performed an EFH assessment for the San Diego Regional Beach Sand Replenishment Project (SANDAG 2000). This assessment will be used for guidance on the potential effects of the jetty restoration project on EFH.

The eight regional fisheries management councils designate EFH for each managed fishery with the assistance of the National Marine Fisheries Service. The jetty restoration project is located in an area designated as EFH in the Coastal Pelagics Fisheries Management Plan (FMP) and the Pacific Groundfish FMP. The Coastal Pelagics FMP includes four finfish (Pacific sardine, chub mackerel, northern anchovy, and jack mackerel) as well as market squid. The Pacific Groundfish FMP includes 83 species, many of which are rockfish (*Sebastes spp*.). EFH for both plans is defined generally as the ocean area from the coastal lagoons up to 200 miles offshore. The species most commonly found in the vicinity of the jetty restoration project include jack mackerel, chub mackerel, Pacific sardine, northern anchovy, California skate, California scorpionfish, pacific sanddab, and leopard shark. NOAA National Marine Fisheries Service considers surfgrass beds in southern California to be Essential Fish Habitat. Juveniles of the Olive rockfish, a managed *Sebastes* species under the Magnuson Stevens Fishery Conservation and Management Act that is found from southern Oregon to Islas San Benitos (central Baja California), utilize surfgrass beds as a nursery area.

California Code of Regulations

Both eel grass and surf grass are protected under the sport fishing and marine plant harvesting regulations under Title 14 Sections 30.10 and 165(4).

4.1.3 Significance Criteria

Impacts to biological resources were considered significant if they resulted in one of the following:

- Substantially impact biologically significant habitats such as surfgrass beds and kelp forests;
- Substantially affect the habitat or a population of a rare, threatened, or endangered species or species of concern;
- Substantially impact fisheries protected under EFH designation;
- Substantially affect the movement of any resident or migratory fish or marine wildlife;
- Substantially impact the biological communities associated with the seafloor beyond the footprint of the jetty restoration;
- Substantially affect a population of marine mammals, sea turtles, or seabirds;
- Result in an injury, mortality, or what could be considered a Level A take under the Marine Mammal Protection Act (MMPA); or
- Result in disturbance or spread of invasive species such as *Caulerpa taxifolia*.

4.1.4 Impact Analysis and Mitigation

Following construction, the proposed Project has the potential to modify beach processes and ocean currents in a manner that could cause substantial erosion and sedimentation, which in turn could cause impacts on coastal zone biological resources. Other aspects of the proposed Project, including the construction and the presence of an extended jetty, were determined to have Class III impacts on biological resources, as discussed below.

The most important impact of the jetty restoration on biological resources would be the accumulation of sand in the vicinity of the jetty that has the potential to bury the low-lying reefs. The potential accumulation patterns of sand have been estimated by several methods, as described in Section 4.2, Hydrology and Water Quality. These included the use of historic and recent aerial photographs, a review of other jetties in the area, modeling, and mathematical calculations. Based on these potential accumulation patterns, the proposed Project was determined to have the potential to impact subtidal and intertidal resources, specifically kelp beds and the macroinvertebrate community in the subtidal environment and surfgrass populations in the intertidal environment. These and other potential impacts are discussed below.

Impact BIO-1: Increased Fish Foraging at Jetty

The new jetty structure will potentially attract a variety of fish that will use the jetty for both shelter and food. (Class IV).

The extended jetty structure, especially the portion below MLLW, will act as an artificial reef in the nearshore habitat providing intertidal rocky habitat and replacing mixed sand and hard bottom habitat. The new structure will attract a variety of fish that will use the jetty for both shelter and food. These fish will also forage on the nearby sand habitat and low-lying natural reefs where they could impact invertebrate populations in these habitats (Davis et al. 1982). The sand bottom communities in the vicinity of the jetty are typical of nearshore sand habits in southern California. Species numbers and species diversity are low due to the constant reworking of the sand substrate by wave action. There are no invertebrate species of special interest, such as sand dollars, in the area that would be significantly impacted by increased fish grazing. A few of the fish species that could be attracted to the reef structure, such as opaleye, are herbivores, but fish grazing does not appear to be a significant factor for surfgrass or eelgrass populations. The nearby *Macrocystis* beds are too far offshore to be significantly affected by increases of herbivores on the new jetty structure. For these reasons, the project-related addition of hard bottom substrate is considered a Class IV impact and no mitigation is necessary.

<u>Mitigation Measure For Impact BIO-1: Increased Fish Foraging at Jetty</u>

MM BIO-1: No mitigation is required.

Impact BIO-2: Settlement of Jetty by *Caulerpa taxifolia*

Habitat provided by reconstructed jetty could be utilized by *Caulerpa taxifolia*, although it is unlikely that any *Caulerpa* settlement will occur (Class III).

The large amount of new rock provided by the jetty restoration would provide substrate for settlement of *Caulerpa taxifolia* that would be free from competition from other species of plants and encrusting invertebrates. It is unlikely, however, that any *Caulerpa* settlement will occur because no *Caulerpa* has ever been found in either the Middle or Outer lagoons and no *Caulerpa* has been found in the Inner Lagoon since the summer of 2002 (Merkel and Associates 2004a). Monitoring efforts for *Caulerpa taxifolia* in the Lagoon will continue and, if detected, will be immediately eradicated from the area. For these reasons, the potential for *Caulerpa taxifolia* to settle on the project-related additional hard bottom substrate is considered a Class III impact and no mitigation is necessary.

<u>Mitigation Measure For Impact BIO-2: Settlement of Jetty by *Caulerpa taxifolia*</u>

MM BIO-2: No mitigation is required.

Impact BIO-3: Loss of Sessile Invertebrates

Some population of sessile invertebrates on lower relief areas would be lost, but this would not substantially reduce the populations or substantially modify the ecosystem in general (No mitigation, Class III).

The new jetty structure will have two mechanisms by which it can affect local sediment deposition patterns. The first is to physically block local sediment transport. The predominant direction of sand transport in this area is from the north; sand will accumulate on the north side of the new jetty structure. The jetty can also cause local diffraction of waves that could cause sand deposits to be formed within a 400-foot arc of the new jetty structure (Hofman Planning Associates 2001).

The local kelp beds do not appear to be susceptible to sand burial due to the reconstruction of the jetty because the nearest area of persistent kelp is over 800 feet from the end of the restored jetty. Most of the macroinvertebrates in the local subtidal are motile and adapted to the shifting sand habitat. Most of the sessile macroinvertebrates, such as the sea fan (*Muricea*), occur on the higher relief reefs above the area where sand burial would occur. Some population of sessile invertebrates on lower relief areas would be lost due to sand deposition, but this would not substantially reduce the populations or substantially modify the ecosystem in general. Therefore, this Project-related effect of altering the existing wave regime is considered a Class III impact and no mitigation is necessary.

<u>Mitigation Measure For Impact BIO-3: Loss of Sessile Invertebrates</u>

MM BIO-3: No mitigation is required.

Impact BIO-4: Impacts to Surfgrass Population

Surfgrass would potentially be buried by sand deposition associated with the restored jetty (Class II impact).

The Project has the potential to block some of the local sand transport and cause a buildup of sand on the beaches to the north of the restored jetty. The extent of this sand buildup is described in Section 4.2, Hydrology and Water Quality. Figure 4.1-11 shows the results of the beach width predictions overlaid onto the composite surfgrass distribution determined from the 2001 and 2002 surveys. The beach width prediction shown in Figure 4.1-11 shows the location of the mean low water (MLW) elevation. The tide level was used to estimate the extent of burial even though the surfgrass populations in this region extend only up to MLLW level. The surfgrass populations in the region of the new MLW elevation occur on rocky substrate with vertical relief of over 2 feet that will provide them with some degree of protection from sand burial. The total area of the surfgrass populations on the reefs in the vicinity of the jetty entrance is estimated to be 11.0 acres. The area of surfgrass potentially buried by the permanent buildup of sand north of the restored north jetty is estimated to be 1.2 acres. This potential, indirect loss of approximately 10 percent of the population is considered a Class II impact because the loss would be significant to the local rocky subtidal community. However, mitigation is available to avoid the losses if the predicted sand deposition occurs.

<u>Mitigation Measure For Impact BIO-4: Impacts to Surfgrass Population</u>

MM BIO-4: Habitat Compensation and Annual Monitoring. Monitoring of North Beach hard substrate reefs for 5 years will be used to quantify any losses to surfgrass populations. Monitoring should consist of a combination of aerial and on the ground transect surveys. An aerial survey should be done immediately before reef construction to quantify

INSERT FIGURE 4.1- 11

the aerial extent of the surfgrass populations. The aerial survey should be conducted at low tide with clear offshore water conditions. A ground truth survey using the transect survey methods for surfgrass developed by the California Multi-Agency Intertidal Monitoring Network (Dunaway et al. 1997) should be conducted coincident with the aerial survey. At least one transect should be surveyed on each of the 5 main reefs in the Tamarack reef complex. The transects will run from approximately + 0.5 feet MLLW down to the lower limit of the surfgrass populations at approximately -10 feet MLLW. The transect surveys should then be conducted twice a year during the summer and late fall to document the full extent of sand variability in this region. The transect surveys will focus on sand thickness and surfgrass viability. A final aerial survey at the end of the 5-year monitoring period, combined with the results of the transect surveys, will be used to quantify the extent of any surfgrass population changes.

After the five year monitoring period any surfgrass areas that have remained covered by greater than 1.5 feet of sand for a period of time longer than 2 years will be mitigated. The area of surfgrass loss will be calculated from a combination of the aerial imagery and data from the permanent transects. The aerial imagery will provide an estimate of the areas of surfgrass, unvegetated reef, and sand at the beginning and end of the monitoring period. The transect data will provide information on sand depth, duration of burial, and surfgrass leaf density and length. These data will be combined to provide an overall map of surfgrass change due to the reconstructed jetty from which area estimates can be calculated.

Surfgrass habitat indirectly lost as a result of the proposed Project will be compensated by transplanting small sprigs of surfgrass rhizomes using the methods described by Bull et al. (2004). The transplanting will be done on the rocks of the reconstructed north jetty at an elevation below MLLW. The south jetty could also be used if more substrate is required than is available on the north jetty. Surfgrass, habitat lost due to Project impacts will be mitigated at a net ratio of 1:1, with adequate and appropriate monitoring as necessary to ensure the viability and success of the transplanted areas. The Applicant shall submit to the CSLC Annual Monitoring Reports documenting the success of all restoration and mitigation efforts, including percent survival by plant species and percent cover. The reports shall include discussion of any monitoring activities and exotic plant control efforts. Representative photographs shall be included in the reports. The reports shall be submitted by January 1 of each year for a period of five years after mitigation efforts begin. A final survey and report of the transplanted areas will be completed at the end of a five-year monitoring period to quantify the viability and success of the transplanted surfgrass populations.

<u>Rationale for Mitigation</u>

Presently, it is uncertain whether surfgrass would be buried from sand deposition associated with the proposed Project and to what extent burial would occur. Monitoring is proposed to determine the extent of potential impacts. Surf grass populations lost to sand burial associated with the proposed Project would be restored on hard bottom substrate associated with the restored jetty and within the project area in close proximity to the affected surfgrass populations.

Impact BIO-5: Impacts to Turf Algae, *Eisenia*, and Associated Invertebrates

Loss of turf algae, brown kelp, *Eisenia*, and associated invertebrates through sand burial (Class III)

The Project also has the potential to cause the loss of populations of turf algae, populations of the brown kelp, *Eisenia*, and various invertebrate populations associated with rocky substrate through burial by sand north of the proposed Project. These populations are abundant and widely distributed in southern California and their loss would not substantially reduce the populations nor substantially modify the ecological conditions. For these reasons, these potential effects are considered to be Class III impacts and no mitigation is necessary.

<u>Mitigation Measure For BIO-5: Impacts to Turf Algae, *Eisenia*, and Associated Invertebrates</u>

MM BIO-5: No mitigation is required.

4.1.5 Impacts of Alternatives

No Project Alternative

The No Project Alternative would avoid the potential impacts to biological resources associated with the proposed Project. However, the Project objective of decreasing the frequency of dredging in Agua Hedionda Lagoon would not be achieved.

The No Project Alternative would require the continued dredging of the Lagoon at the same frequency and intensity as the current dredging regime. Extensive dredging in the past has had negative effects upon eelgrass populations within the Lagoon. These populations are removed during the next dredge cycle in the area. Overall impacts of past dredging activities have been small and temporary and do not appear to rise to the level of a Class II impact. For these reasons, the effects of the No Project Alternative on existing eel grass populations are considered to be Class III impacts and no mitigation is necessary. Future dredging is also a risk to dispersing *Caulerpa* populations that could become reestablished within the Lagoon. However, *Caulerpa* populations have never been found in either the outer or middle basins of the Aqua Hedionda Lagoon and no populations in the inner basin have been found since the fall of 2002. Monitoring supported by the Southern California *Caulerpa* Action Team (SCCAT) will continue another year. Per objectives of the Task Force, if *Calurepa* populations are not found during the monitoring period which ends in 2005, *Caulerpa* will be considered eradicated in Aqua Hedionda Laoogn. Therefore the potential for *Caulerpa* establishment is considered low and is a Class III impact.

There is also a potential for turbidity from the dredging operations to impact the recruitment of *Macrocystis* and other kelp species in the vicinity of the entrance channel if the turbidity occurs during one of the infrequent "recruitment windows" for these species when nutrient and light levels are sufficient for the production of eggs by the microscopic gametophyte stage of these kelps (Deysher & Dean 1984). Natural turbidity in the region is variable and the *Macrocystis* is adapted to varying turbidity regimes. This impact is considered to be Class III.

Reduced Maintenance Dredging Alternative

This Alternative would avoid the potential impacts to biological resources associated with the proposed Project. In addition, impacts to the biological resources in Agua Hedionda Lagoon would be reduced as a result of more limited dredging. The Project objective of decreasing the frequency of dredging in Agua Hedionda Lagoon could be achieved since accelerated sedimentation rates would be avoided, but this would need to be confirmed through monitoring. Overdredging increases water velocities and sand suspension, and accelerates sedimentation in the Lagoon. Reducing the amount of dredging in the Lagoon has the potential to keep water velocities lower and avoid accelerated sedimentation. This would be considered a Class IV beneficial impact.

Offshore Water Intake Structure/Cessation of Lagoon Maintenance Dredging Alternative

This alternative would avoid the potential impacts to biological resources associated with the proposed Project and would avoid the negative effects on biological resources associated with the dredging of Agua Hedionda Lagoon. With appropriate mitigation, it would achieve all of the Project objectives while avoiding significant adverse impacts.

A change in the location of the cooling water intake location from within the existing site within the Outer Basin of the Lagoon to an offshore intake is discussed below.

The cooling water intake structure and associated pipeline could be constructed in sandy habitat directly offshore of the Encina Generating Station and north of the Encina kelp bed (Figure 4.1-4). This sandy bottom habitat undergoes dramatic seasonal as well as short-term changes due to the variable wave regime in the area. Impacts to the communities in this habitat, therefore, would be temporary and the impacted communities will return quickly to preconstruction conditions. This is a Class III impact. The one potential difference between the present cooling water intake that is located within the Outer Basin of the Lagoon and an offshore intake is in the population of organisms that would be impinged and entrained into the cooling water system. Data used to determine the potential of any significant impacts due to changing the location of the cooling water intake were obtained from a Supplemental 316(b) Assessment Report prepared for the Station in 1997 (EA Engineering Science Technology 1997); the 316(b) Demonstration Report (SCE 1982) for the San Onofre Nuclear Generating Station, which has an offshore cooling water intake; and the 2002 NPDES Annual Receiving Water Monitoring Report for San Onofre (SCE 2003), which contains a summary of the fishes impinged by the cooling water intakes.

The 1997 Supplemental 316(b) Assessment models the entrainment, impingement, and adult equivalent losses of critical species that could be affected by the cooling water intake within the Lagoon. These critical species were chosen based on the following conditions:

- Distribution within the vicinity of the cooling water intake in the Lagoon system;
- Representative of a balanced, indigenous community of fish, shellfish, and wildlife;
- Commercially or recreationally valuable;
- Threatened or endangered;
- Critical to the structure and function of the local ecological system;
- Potentially capable of becoming localized nuisance species;
- Necessary in the food chain for the well-being of the species determined by the above criteria;
- High potential susceptibility to entrapment-impingement and/or entrainment.

This report concluded that the fish community was the most susceptible to impact from the intake structure. One of the reasons for not including other communities, such as the phytoplankton and zooplankton communities, is that these assemblages in the Outer Lagoon do not contain any unique species not found in the offshore waters in this region. A suite of 17 fish species was selected as the critical set of species that were considered for the assessment of the intake structure. Table 4.1-2 lists these species in the rank order of the estimated annual impingement losses due to the Station intake structure and compares them to the rank of the species at the offshore intake for the San Onofre Nuclear Generating Station. The majority of individuals (96 percent) are similar within the top ranked species between the two cooling water systems.

The Supplemental 316(b) Assessment report also looked at the distribution of 17 critical species within the Lagoon system and in the nearshore waters near the power station. They concluded that only the Striped Mullet had a significantly different distribution between the two areas in terms of larvae, juveniles, and adults. The Tidewater Goby was included in this list because it is an Endangered Species and the Lagoon is a potential habitat for this species. However, no populations of this species have been found in the Lagoon.

Table 4.1-2. Rank order of fish species impinged by the Encina Power plant compared to the rank order of these species impinged by the nearshore cooling water intake of the San Onofre Nuclear Generating Station (SONGS).

Critical Species	Individuals per year	Percent of Total	Rank order at SONGS
Queenfish	13,925	40.3	1
Topsmelt	10,042	29.0	11
Northern Anchovy	6,580	19.0	2
Walleye surfperch	1,789	5.2	9
California Halibut	933	2.7	>15
Giant Kelpfish	846	2.4	5
Barred Sand Bass	138	0.4	>15
Corbina	79	0.2	>15
Barred Surfperch	72	0.2	>15
Striped Mullet	59	0.2	>15
Spotted Sand Bass	54	0.2	>15
Kelp Bass	32	0.1	>15
White Seabass	19	0.1	>15
Hornyhead Turbot	0	0.0	>15
Pacific Sanddab	0	0.0	>15
California Sheephead	0	0.0	>15
Tidewater Goby	0	0.0	>15

There do not appear to be any significant impacts to fishes or any other populations resulting from a move of the cooling water intake from the Outer Basin of the Lagoon to the shallow nearshore waters directly offshore of the power station. The numbers and species of fish that would be impinged and entrained by the offshore cooling water system would be similar to those now entrained by the intake structure in the Lagoon. Therefore, this would be considered a Class III impact and no mitigation would be necessary.

One anticipated benefit of the reduced volume of dredging after the jetty reconstruction will be a decrease in the amount and duration of turbidity within the Lagoon and nearshore waters, which is considered a Class III impact. This is considered a Class III impact since no quantifiable estimate of this benefit can be calculated since there are no studies or data available that provide estimates of the impacts of the current turbidity regime on eelgrass or kelp populations and no estimates of the amount that turbidity will be reduced.

Decreased dredging would also decrease the possibility of any *Caulerpa* populations resident within the Lagoon being dispersed by the dredging operations and is considered a Class III impact because *Caulerpa* populations have not been found in this region.

Impact Alternative 1 BIO-1: Impacts from closure of the entrance to the Agua Hedionda Lagoon due to cessation of Maintenance Dredging

Closure of the entrance to the Aqua Hedionda Lagoon would degrade water quality due to lack of tidal circulation and adversely impact biological values of the Lagoon (Class II)

While the negative effects of dredging on biological resources in Agua Hedionda Lagoon would be avoided, there could be significant impacts to biological values if the entrance to the Lagoon were allowed to close and water quality were allowed to become degraded through lack of tidal circulation. This is considered a Class II impact.

Mitigation Measure for Impact Alternative 1 BIO-1: Impacts from closure of the entrance to the Agua Hedionda Lagoon due to cessation of Maintenance Dredging

MM ALT. 1 BIO-1: Maintenance dredging. Maintenance dredging will be required to assure adequate tidal circulation is maintained in Agua Hedionda Lagoon. The minimum maintenance dredging necessary to allow tidal circulation to maintain current recreational, biological, and aesthetic values of the Lagoon would be an estimated 20,000 cubic yards per year. Dredging would be reduced from the current average of 134,000 cubic yards per year to 20,000 cubic yards per year.

<u>Rationale for Mitigation</u>

To assure tidal circulation in the Lagoon, the entrance must be kept open and the only method to accomplish this is to conduct maintenance dredging.

Impact Alternative 1 BIO-2: Impacts to eelgrass populations from dredging in cooling intake structure channel in Aqua Hedionda Lagoon

Elimination of dredging in cooling intake structure channel would benefit eelgrass populations in the channel (Class IV)

The eelgrass population of the outer basin of Agua Hedionda Lagoon has varied in size between 5.0 and 10.4 acres during the last five years (Merkel & Associates 2000, Merkel & Associates 2004). Much of this variability is due to natural causes, but some is due to dredging within the Lagoon (Merkel & Associates 2001). The damage due to dredging appears to be more a function of where the dredging is performed than due to the volume of sediments dredged during a project. A planned 450,000 yd^3 dredging project for January 2005, which is near the upper end of the 500,000 yd^3 permit limit for dredging within the outer Lagoon, is estimated to impact only 0.019 acre of eelgrass (Merkel & Associates 2004). This dredge project will focus on the sandbar that forms just southeast of the Lagoon entrance.

It appears that most damage to eelgrass occurs during dredging of the channel to the cooling water intake structure. The elimination of this intake structure will eliminate the need for dredging in this region and could potentially benefit eelgrass populations. Sediment accumulation in the southern portion of the basin after the discontinuation of operation of the intake structure could bring more of the bottom substrate above the –12 m threshold for eelgrass growth and could expand the area for potential eelgrass colonization. For these reasons this is considered a Class IV impact.

<u>Mitigation Measure For Impact Alternative 1 BIO-2: Impacts to Eel Grass Populations</u>

MM ALT. 1 BIO-2: No mitigation is required.

4.1.6 Cumulative Projects Impact Analysis

Both the SANDAG Regional Beach Sand Project and the proposed Project would continue periodic disposal of beach sand upcoast of the proposed Project, which would have the potential to increase the width of the beach north of the upcoast jetty. The amount of beach sand deposited by the Applicant following completion of the proposed Project is expected to be reduced since the extended jetty is designed to reduce the frequency and amount of maintenance dredging. Nevertheless, the cumulative effect, if any, would be an augmentation of the beach and a reduced conflict with adopted plans and policies that favor maintenance of wider beaches. Neither of these projects, as currently proposed, targets Middle Beach or South Beach, and therefore neither would likely reduce cumulative impacts to a less-than-significant level. However, if approved, the proposed Project will include mitigation that obligates the Applicant, as necessary, to maintain Middle and South beaches at 2001 widths, which would mitigate this potentially significant cumulative impact (Class II).

Implemented in 2001, the SANDAG Regional Beach Sand Project increased beach width at North Beach by 11 feet to 27 feet close to the existing northern inlet jetty, and by 60 feet at the northern-most extent of Carlsbad State Beach (see Appendix C). The Applicant's disposal of sand at North Beach may also have contributed to this increase in width. The SANDAG project had no lasting effect on the widths of Middle Beach or South Beach.